REMARKS/ARGUMENTS

Reconsideration and allowance in view of the foregoing amendment and the following remarks are respectfully requested.

Claims 1, 4-11 and 13-15 are now pending.

In response to applicant's arguments filed February 1, 2005, the Examiner has noted that Miwa teaches certain types of cast iron piston rings and that Metals Handbooks discloses that ductile iron has a modulus of elasticity that allegedly falls within the claimed range. From these references the Examiner has concluded that the claimed piston ring composition is "conventional". Applicant respectfully requests reconsideration.

As noted in greater detail below, Metals Handbook does not teach or suggest that ductile iron could or should be used for a piston ring much less in the combination claimed. In this regard, applicant does not claim to have invented, *per se*, an iron alloy having an elastic modulus ranging from 130000 to 170000 MPa. Applicant does claim, however, to have invented the combination of a piston ring made of a (one of two) certain selected type of graphite cast iron and having an elastic modulus in this range, that is hard coated on at least its sliding surface, and fitted in a steel piston ring groove, in particular as a solution to the problem of coagulation or adhesion between the lower (or upper) surface of the piston ring and the inner surface of the ring groove contacted therewith.

Thus, the mere fact that the Examiner has identified a reference source disclosing ductile iron as having a giving range of modulus of elasticity does not teach or suggest that an alloy having that modulus of elasticity would be an "obvious choice" for a piston ring having a hard coat film at least on its sliding surface and fitted to a steel ring groove. That and other gaps in the teachings of the cited prior art clearly distinguish the claimed invention from the teachings of the prior art so that the

invention would not have been obvious to the skilled artisan without the benefit of applicant's disclosure.

Claims 1-13 were collectively rejected under 35 USC 103(a) as being unpatentable over Gale et al in view of Ogawa et al. Applicant respectfully traverses this rejection.

To reiterate, the present invention is provided to address in particular the problem of adhesion between the lower (or upper) surface of the piston ring and the inner surface of the ring groove contacting the same. Applicant has recognized that this object may be achieved by providing a piston having a piston ring groove formed of steel, more specifically SKD6, SUS304 or SUS630, and a piston ring fitted in that piston groove and made of a specific cast iron having a specific elastic modulus, more particularly, made of flake graphite cast iron or spheroidal graphic cast iron, having an elastic modulus ranging from 130000 to 170000 MPa, and wherein a hard coat film is formed on the outer peripheral sliding surface of the piston ring.

Applicant has discovered that with the foregoing combination of piston and piston ring, the assembly can provide superior durability and superior follow-up performance. The product of the invention can be advantageously applied to a high-power internal combustion engine, such as a diesel engine, requiring high combustion temperature and high combustion pressure.

To summarize the foregoing, the present invention provides an assembly having in combination the following specific characteristics:

1. At least a lower surface of the piston ring is formed with irregularity on the surface due to an existence of the graphite;

2. The lower surface of the piston ring is fitted (contact) to the lower surface of the piston ring groove;

3. A hard coat film is formed on an outer peripheral sliding surface of the piston ring;

4. The piston ring is made of flake graphite cast iron or spheroidal graphite cast iron having an elastic modulus ranging from 130000 to 170000 MPa; and

5. The ring groove is made of SKD6 (JIS code of steel for hot-rolling die), SUS304 (JIS code of austenitic stainless steel), or SIS630 (JIS code of precipitation-hardened stainless steel).

With above-noted combination of features, as recited more specifically in amended claims 1 and 13, any coagulation or adhesion is avoided particularly in a high-power engine, such as a diesel engine, such that the invention has effectively achieved its object of avoiding such coagulation or adhesion and is clearly advantageous over the prior art. It is further respectfully noted that according to the present invention, any coagulating or adhesion is not caused even where the piston and piston ring are directly contacted at their lower surfaces. In this regard, where the piston and piston rings are not directly contacted, then the problems specifically addressed by the present invention are not an issue because the problem addressed by the invention is specifically directed to coagulation or adhesion of the contacting surfaces.

The Examiner has characterized Gale as teaching a piston having a ring groove made of steel and a piston ring made of cast iron selected from the grouped claimed and having an elastic modulus as claimed. In response to applicant's challenge that the Gale disclosure does not mention any particular piston ring composition or elastic modulus but refers only to "a conventional piston ring", the Examiner has taken the position that the newly cited Miwa patent (which has not been included in the statement of rejection) establishes that certain cast iron materials are known for piston rings and that a hard chromium plating layer on the outer peripheral sliding surface thereof is also known. Even in this respect, however, the Examiner concedes that there

is no teaching in Gale or Miwa of any particular elastic modulus. However, the Examiner then refers to a further disclosure of Metals Handbook (also not cited in the Statement of Rejection and not included on the Examiner's Form 892) allegedly teaching that ductile iron has an elastic modulus in the range claimed. The Examiner then summarily concludes that the convention piston ring Gale refers to is a piston ring formed from the particular cast iron recited in applicant's claim and has an elastic modulus in the range set forth in applicant's claim. Applicant respectfully disagrees.

While Metals Handbook discloses "ductile iron" having an elastic modulus in a particular range, neither Metals Handbook nor the remaining art directly or indirectly relied upon by the Examiner teaches that "ductile iron" is known for or would be obviously used for the piston ring in Gale. Miwa does state that flaky graphite cast iron material (specifically FC250 or FC300) and certain other cast iron materials have been used for piston rings, but neither Miwa nor the remaining art of record teach or suggest that the "ductile iron" the Examiner has found in Metals Handbook is a known choice for a piston ring, much less that the elastic modulus of the piston ring is considered relevant in determining the composition of a piston ring. Indeed, there is no apparent mention in any of the piston ring art the Examiner has cited of the elastic modulus of the ring or that it is of any particular issue or concern in piston ring design.

Section 103 does not allow the Examiner to engage in picking and choosing from the prior art only to the extent that it will support a holding of obviousness, while excluding parts of the prior art essential to the full appreciation of what the prior art suggests to one of ordinary skill in the art. In re Wesslau, 147 USPQ 391 (CCPA 1975).

As the CAFC has said, obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. ACS Hospital Systems v Montefiore Hospital, 221 USPQ 929, 933 (Fed. Cir. 1984). There must be a suggestion in the art

relied upon to use what one reference discloses in or in combination with the disclosure of the other reference or references relied upon by the Examiner. In re Grabiak, 226 USPQ 870, 872 (Fed. Cir. 1986).

Thus, applicant has discovered that a particular combination of materials is uniquely advantageous in addressing the particular problem associated with piston ring adhesion in a piston ring groove, in particular providing a piston ring as now claimed, selected from one of two materials having a particular elastic modulus, and fitted in a piston ring groove formed from one of three select materials and further wherein the lower surface of the piston ring is formed with irregularity on the surface due to an existence of the graphite and the lower surface of the piston ring is fitted to contact the lower surface of the ring groove.

While the Examiner has identified certain cast iron materials as known for piston rings and that the concept of a coating for the sliding surface of piston rings is known in various prior art assemblies, consideration to elastic modulus is not taught by the relevant prior art and the unique combination of components claimed is no where suggested in the prior art of record.

It is clear that the initial burden of establishing a basis for denying patentability to a claimed invention rests upon the Examiner. In re Piasecki, 745 F. 2d 1468, 223 U.S.P.Q. 785 (Fed Cir. 1984). In establishing a *prima facie* case of obviousness under 35 U.S.C. § 103, it is incumbent upon the Examiner to provide a reason why one of ordinary skill in the art would have been led to arrive at the claimed invention from the prior art. Ex part Clapp, 227 U.S.P.Q. 972 (BPAI 1985). To this end, the requisite motivation must stem from some teaching, suggestion or inference in the prior art as a whole or from the knowledge generally available to one of ordinary skill in the art and not from applicant's disclosure. See, for example, Uniroyal, Inc. v. Rudkin-Wiley Corp. 837 F.2d, 7 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

Finally, as noted above, even if the piston rings and piston ring grooves cited by the Examiner were to be combined, because of the absence of a teaching of a particular elastic modulus for a piston ring of the composition claimed, it is respectfully submitted that the combination claimed would still not have been anticipated nor obvious from the prior art.

In view of the foregoing, reconsideration and withdrawal of the rejection based on Gale and Ogawa is solicited.

Previously presented claim 1 was rejected under 35 USC 103(a) as being unpatentable over Ahlen. Applicant respectfully traverses this rejection.

The Ahlen reference discloses technology for improving friction characteristics between a seal ring and a seal ring groove in which the seal ring and the seal ring groove are contacted to each other through a molybdenum film formed on either the seal ring or the seal ring groove as shown in Figure 5 thereof. As discussed in Ahlen, the formation of this film is an essential matter for the improvement of the friction characteristics. This differs, however, from the specific combination claimed in which a coagulation problem between the piston ring and the piston ring groove is addressed. Because of the presence of the film of Ahlen, the contact recited in applicant's claim 1 is not anticipated nor obvious. Moreover, it is respectfully submitted that even further in view of the teachings of known materials in Miwa and the Metals Handbook, for the reasons advanced above, the combination of specific materials and characteristics recited in applicant's claims are still not anticipated by nor obvious from Ahlen.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance and an early Notice to that effect is earnestly solicited.

Respectfully submitted,

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